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SUBJECT

Report on the Organization, Operations,
Equipment, and Strategic and Tactical Planning of the
North Vietnamese Antiaircraft Defense System

SOURCE

The document from which the translation was
made is an original, and there is no question concerning
its authenticity.

Summary

Following is a translation of the antiaircraft
defense section of a report, classified Secret, made by
a delegation which toured North Vietnam
In this document, the delegation surveys
the mission, organization, operations, and equipment of
the North Vietnamese antiaircraft defense system, comments
on its strengths and weaknesses, and evaluates the degree
of success it had attained by mid-summer 1967. These
topics are treated under six general headings.

Part A describes the missions and organizational
and operational interrelationships of the various forces
making up the antiaircraft defense system. Responsibility
for the entire North Vietnamese air defense system lies
with a single command, the Air Force and Antiaircraft
Defense Forces Command. This Command is a special organ
of the General Staff and directs the activities of the

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antiaircraft artillery, the antiaircraft missile (SAM) forces, Fighter Aviation, and the radiotechnical forces. Part A also briefly describes the antiaircraft defense forces of the military zones and the antiaircraft artillery forces of the ground forces, neither of which is directly controlled by the Air Force and Antiaircraft Defense Forces Command, and the manner in which their activities are coordinated with the Air Force and Antiaircraft Defense Forces Command.

Part B considers the organization and combat operations of the antiaircraft artillery, which is characterized as the basic and most important branch of the antiaircraft defense system. The antiaircraft artillery has principal responsibility for protecting both fixed and mobile targets from enemy air attack. The principles underlying its manner of deployment, the frequency with which individual units are redeployed, the system by which its units receive essential data on enemy activity, the defense tactics used in protecting various types of targets, and the procedures followed in coordinating its operations with the missile forces and Fighter Aviation are described in some detail. Note is taken of the fact that the expenditure of antiaircraft artillery ammunition required to destroy enemy aircraft has greatly increased since the early stages of the war because of the improved operating methods of enemy aircraft and the improvement of enemy countermeasures against North Vietnamese artillery radar equipment. The statement is made that as of the end of 1966, antiaircraft artillery and machine guns had accounted for 80 percent of all enemy aircraft brought down over North Vietnam. Part B ends with a brief sketch of combined air operations, which are described as an advanced form of air war utilizing the coordinated efforts of antiaircraft and missile units and Fighter Aviation.

Part C outlines the organization and combat operations of the North Vietnamese missile forces. Missile units are directed by the Missile Forces Command, a branch of the Air Force and Antiaircraft Forces Command. The basic operational unit is a regiment of four to six battalions equipped with the SA-75M [] type missile system (SA-2) and 11D missiles (GUIDELINE MOD 2). The principles governing the disposition of the battalions, tactics, and frequency of movement are considered, together with the methods they have developed of countering "Shrike" missile attacks against their missile guidance stations (FAN SONG). The document points out that

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movement is still considered a basic tactic for ensuring the survival of the missile units. The rate of march of a missile battalion is stated to be 15 kilometers per hour and experience has shown that a missile battalion can cover from 50 to 70 kilometers per night, when all such moves are executed. As of the beginning of April 1967, the missile forces are credited with having downed 365 U.S. aircraft. The most highly trained missile battalions operate along the Vietnamese coast and in the approach corridors most used by U.S. aircraft.

Part D deals with the organization and combat operations of Fighter Aviation. Fighter Aviation is a new type of aviation in North Vietnam, where it did not exist prior to early 1965. Despite this, within a two-year period of operation it is credited with downing at least 114 enemy aircraft, 63 being accounted for by MIG-17's and at least 51 by MIG-21PF's. Because of a limited capability of replacing pilots and equipment, the North Vietnamese engage in airbattles only under what they consider to be the most favorable conditions. The missions of Fighter Aviation are narrowly defined because of the comparatively small number of aircraft available and the limited capabilities for their deployment. Basic missions are limited to the defense of Hanoi and other key North Vietnamese targets, and the destruction of U-2 and BQM-34A reconnaissance aircraft and RB-66 aircraft. When not needed for the defense of the Hanoi area, fighter aircraft protect Highway No. 5, the port of Haiphong, the redeployment of missile battalions, and the Red River defense fortifications. Their method of conducting combat operations, command and control techniques, joint operations with surface antiaircraft defense forces, and their use of missiles against enemy aircraft are analyzed. Finally, the effectiveness of North Vietnamese Fighter Aviation is evaluated. Increased combat experience is credited with a recent reduction in the loss of North Vietnamese aircraft.

Part E describes the methods which have been developed for identifying enemy aircraft and the creation of a North Vietnamese warning system. Most of this section deals with the organization and operations of units subordinate to the Radiotechnical Forces Command. Radiotechnical companies are of two types: one designed to detect and identify the air enemy; the other, to detect and guide North Vietnamese fighter aircraft to enemy targets. The basic equipment of the first type consists of radar stations P-10 (KNIFE REST B), P-12

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(SPOON REST), P-15 (FLAT FACE), and the Chinese-produced 406. The basic equipment of the second type of company consists of radar stations P-30 (BIG MESH?) and P-35 (BAR LOCK). Their deployment and redeployment, their states of combat readiness, and their system of communications are described, as well as the independent and widespread visual observation post system organized by local militia-type forces. Finally, a brief sketch is given of the methods employed in alerting the military forces and the civilian population to enemy air attacks.

Part F is a brief treatment of antiaircraft defense within the Territorial Defense System. It deals in summary fashion with such topics as evacuation of the population and industrial installations, the construction of shelters, camouflage, rescue work, and difficulties in the development of an observation and warning system under the conditions existing in North Vietnam. The section concludes with the statement that U.S. aircraft are fired at from every insignificant village and factory, a practice which has a significant impact on the maintenance of popular morale. This type of fire is credited with having accounted for about five per cent of the total number of enemy aircraft destroyed.

End Summary

Comment

Four pages of this report, covering the end of a section on "Antiaircraft Defense of Airfields" and the beginning of a section on "Organization of the antiaircraft artillery/command, divisional are missing. For convenience, the paragraphs of this document have been numbered, although they were unnumbered in the original. The numbering of the diagram and figures is that of the original. When the exact meaning of a term is uncertain, the [] included in brackets the first time it is used.

Two other parts of the delegation's report will be issued when translated: one, a description of the North Vietnamese communications system; the other, the summary and conclusions from the delegation's report. The remainder of the report is not available.

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SECRETANTIAIRCRAFT DEFENSEA. Antiaircraft Defense Forces and Missions

1. The turning point in the antiaircraft defense organization came with a 1959 Party Central Committee directive ordering expansion of the Antiaircraft Defense Forces [] and close liaison among and joint action by all antiaircraft defense units, regardless of organization subordination and dependence. This directive integrated the efforts of the [] subordinate to the Air Force and the OPL Command with those of the antiaircraft defense military zones, militia units [] of the [] and the antiaircraft defense forces of the ground forces.

2. Diagram 5 shows the organization and subordination of specific forces [see page 6].

3. It is worth noting in this introduction that command of the forces of the antiaircraft defense zone or province, of the militia units of the [] and of the antiaircraft defense forces of the ground forces is exercised either by the [] or by the operational unit of the military zone. On the other hand, the [] within a province are commanded by the provincial military staff which includes antiaircraft defense officers and the provincial [] post. In addition to organizing and conducting combat operations, these command organs are responsible for alerting both the military forces and the population to any threat from the air.

[] Units Subordinate to the Air Force and [] Command

4. These forces consist of tactical formations and antiaircraft artillery units, antiaircraft missile units, fighter aviation and radiotechnical units. The Air Force and [] Command directs the activities of all the above-mentioned forces as well as those of the Air

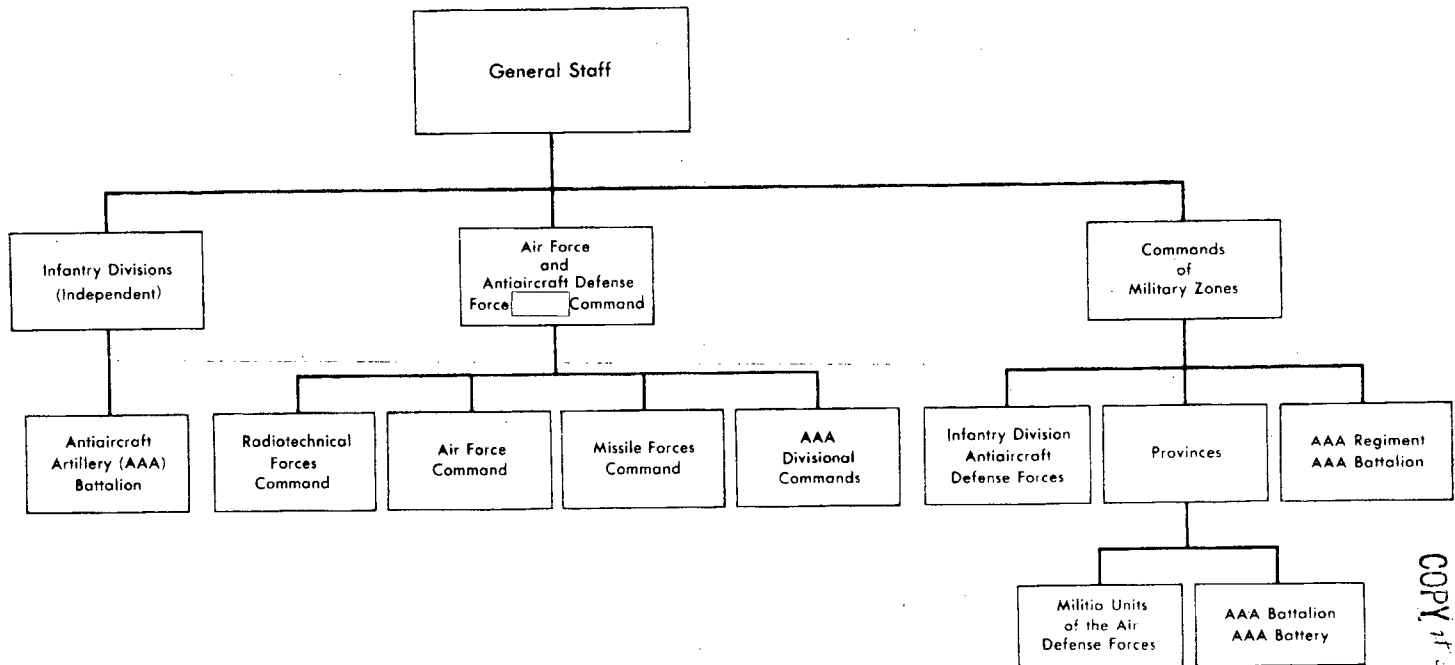
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Diagram 5

Antiaircraft Defense Forces of the Democratic Republic of Vietnam



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and Antiaircraft Defense Forces Staff and the following specialized commands: the Antiaircraft Missile Forces Command, the Air Force Command, the Radiotechnical Forces Command, and the antiaircraft artillery divisional commands.

5. It should be noted in Diagram 5 that the Anti-aircraft Artillery Command does not appear as a separate command. The Staff of the Air Force and [] Command directs the activities of antiaircraft artillery units. Adequate forces of each type of troops are directly subordinate to each of the special commands.

6. The Air Force and [] Command is a special organ of the General Staff and is responsible for the organization and direction of the entire national air defense system.

7. The primary mission of the Air Force and [] are:

- to provide close antiaircraft cover for the country's most important operational and strategic installations;
- to ensure a continuous capability of reinforcing the antiaircraft cover of the various military zones with forces drawn from the missile and antiaircraft artillery troops;
- to conduct continuous air reconnaissance of the enemy and to alert all [] units and commands throughout the nation.

8. The antiaircraft artillery is organized in battalions having dual missions, namely:

- to provide cover for large installations or groups of medium-sized or small installations; for this purpose the battalions are equipped with 37 mm, 57 mm and 100 mm antiaircraft guns;

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- to function as reserves for reinforcing the antiaircraft cover of particular installations or for furnishing antiaircraft cover for installations of temporary importance, and also for organizing and conducting combat operations independently or jointly with other units of the [] in these situations the battalions are equipped with 37 mm and 57 mm antiaircraft guns.

9. The composition of an antiaircraft artillery division ranges from four to eight regiments. A regiment consists of six to ten or more batteries with anti-aircraft guns of various calibers. The batteries have six to eight guns each. Because the number of radar stations of the early-warning radar type is insufficient, those stations under the antiaircraft artillery divisional commands are grouped into early-warning radar companies consisting of several radar stations each.

10. Antiaircraft missile units are organized in independent missile regiments consisting of three to six firing battalions and a technical battalion having one or two assembly lines. Each firing battalion consists of an antiaircraft artillery battalion composed of three 37 mm antiaircraft gun batteries and three anti-aircraft machine gun platoons. The mission of this battalion is to provide close cover for the firing battalion both in combat positions and during regrouping.

11. Fighter Aviation is organized in regiments of three squadrons each. Each fighter aviation regiment has a single type of aircraft, either the MIG-17 or the MIG-21.

12. The Radiotechnical Forces are organized in radiotechnical regiments, each consisting of 10 to 12 radiotechnical companies. The composition of a company varies, ranging from two to four radar stations of various types. Moreover, each radiotechnical company includes an anti-aircraft machine gun platoon which provides close cover for the company. The radiotechnical regiments also include companies having specific assignments, i.e., radiotechnical companies assigned to track and identify

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airborne objects, and companies whose mission is to detect airborne objects and vector fighter aircraft to the targets. These companies are generally deployed near airfields and are subordinate for tactical purposes to the commander of the fighter aviation regiment in question. The commander also determines the organizational assignment of each radar station.

13. The Vietnamese comrades find that such an organizational system for radiotechnical regiments is ineffective in practice. The formation of support battalions for vectoring fighter aircraft to the targets is planned for the near future.

Units Subordinate to Military Zone Commands

14. The antiaircraft defense forces of a military zone consist of antiaircraft artillery battalions and regiments subordinate to the military zone command, and antiaircraft artillery batteries and battalions and antiaircraft machine gun companies subordinate to the provincial command.

15. The troop strength and quantity of equipment of the [] of a given zone or province depends on the number and importance of those installations which are not under the protection of the Air Force []. These forces operate only in a particular zone or province and are subordinate to the military committees of the zone or province.

16. The mission of the [] of a military zone is to provide close antiaircraft cover for important, permanent installations located in that zone and less intensive cover for those installations which are deployed for a specific period of time in a given province, and which are not protected by the Air Force [].

17. The personnel of the antiaircraft defense units of the military zones are regular army soldiers. These units are equipped only with antiaircraft artillery and machine guns. Therefore, these forces include

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antiaircraft artillery units which have not been placed under the Antiaircraft Artillery divisional commands (As is known, these units are directly subordinate to the Air Force and [] Command.) This arrangement permits a decentralized command of the close defense of a given installation. In practice, it means less centralized command down to the level of the anti-aircraft artillery unit or even subunit. It is necessary to point out that the tactical formations and the anti-aircraft missile units of Fighter Aviation and Radio-technical Forces are in no circumstances subordinate to the military zones, but are commanded, so far as operations are concerned, by the various commands at the central level, and in regard to tactical firing, by unit commanders.

Militia Units of []

18. The militia units of the [] consist of subunits armed with 20 mm antiaircraft machine guns and 37 mm and 40 mm antiaircraft guns. The personnel of these subunits are recruited from the work forces of workshops, factories, and collective farms. Platoons and squads are organized to destroy low-flying targets, using hand and automatic weapons.

19. The mission of the militia units of the [] is to provide close cover for their workshops, factories, and villages or settlements. These missions are fulfilled in conjunction with other [] units. Watch crews appointed from the work force of a given workshop, cooperative or village serve in the militia subunits [] These subunits are commanded by the Party military committees of the workshop or cooperative farm.

[] Units of the Ground Troops

20. Antiaircraft defense units and subunits organic to particular infantry divisions belong to the [] Namely, a division contains a 37 mm antiaircraft gun battalion consisting of three batteries and an anti-aircraft machine gun platoon; each infantry regiment also has an anti-aircraft machine gun platoon. Moreover, ground artillery units belonging to infantry divisions

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are equipped with 37 mm antiaircraft cannons; this represents additional combat equipment serviced by the ground artillery crews. In addition, all automatic weapons of a division can be used to destroy low-flying air targets, depending on the situation.

21. The mission of the [] of the ground troops is to reinforce the antiaircraft cover of whatever military zone the ground forces find themselves in at a particular time. Antiaircraft defense units undertake joint action with the adjacent [] units of a given zone, province or installation which fall under the protection of Air Force and OPL.

B. ORGANIZATION AND COMBAT OPERATIONS OF ANTIAIRCRAFT ARTILLERY

Mission, Organization and Combat Operations of Anti-aircraft Artillery

22. Antiaircraft artillery is the basic and most important branch of the Air Force and []. The principal responsibility for protecting an installation lies with the antiaircraft artillery since only it can repulse an enemy air raid. Moreover, antiaircraft artillery is characterized by extensive maneuverability and a high degree of technical efficiency.

23. Antiaircraft artillery is used for the comprehensive protection of both fixed and mobile targets. It may also be used for laying an ambush along the lines of approach to the protected targets.

24. The basic tactical unit of antiaircraft artillery is the antiaircraft artillery regiment. Of mixed composition, it comprises from six to ten or more batteries. Depending on the nature of the protected target, a regiment may have a battalion of small caliber antiaircraft artillery (mostly 37 mm antiaircraft guns); the mission of the battalion is to protect the major element of a particular target. At times, a similar battalion will be assigned to an antiaircraft artillery division.

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25. An antiaircraft artillery regiment may protect one of the following targets: an airfield, a major rail or highway bridge, or an average industrial installation or medium sized city. At times a regiment may protect several targets distributed along a section of highway or within a particular area.

26. The execution of the regiment's combat mission depends primarily on the proper organization and methods of implementation of the fire system. This requires effective control of the air space at medium and low altitudes, and of all possible directions of approach to the protected target by enemy aircraft. Fulfillment of this requirement permits the concentration of maximum fire power at the right time in the direction of greatest threat. Moreover, it is necessary to consider the regiment's fire distribution in relation to the technical capabilities of the equipment and the established method of operation of enemy aircraft. For example, medium caliber anti-aircraft artillery should fire at the aircraft before they start to dive, while small caliber antiaircraft artillery should fire at the aircraft during the dive and in low altitude flight. The individual regimental batteries should be deployed in conformity with these requirements, keeping in mind the type of equipment and the characteristics of the terrain in the emplacement area. Medium caliber antiaircraft artillery batteries should be arranged in battery groups in a single combat formation in each area, so as to form a concentrated fire force in a particular direction. In addition, medium caliber battery groups should be maneuvered from one area to another, thus posing a threat to enemy aircraft in the primary directions of approach to a protected target.

27. Small caliber antiaircraft artillery batteries should also be arranged in groups and should be deployed in and around the immediate vicinity of a target. They should be oriented so as to take advantage of the most likely directions of attack by enemy aircraft diving on the target.

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28. Part of a small or a medium caliber battery may be deployed at the more distant approaches to the last target. The best trained and the strongest batteries should be the main batteries assigned to protect the target. These batteries should occupy the best emplacements and should not be moved as often as other units. The remaining batteries should be maneuvered around the main batteries, which should constitute the basic core of the cover for a particular target; each regiment should have at least three such batteries.

29. In order to ensure the efficient maneuvering of individual batteries, the appropriate number of gun emplacements and the route of movement should be prepared in advance. In addition to the basic gun emplacements, two or three alternate emplacements and one dummy emplacement should be prepared for each battery. The emplacements should be thoroughly camouflaged. In addition to the mock combat equipment, gun shots should be simulated at the dummy emplacements during an air attack. All the main and alternate emplacements are firmly constructed and readied for action throughout the year. The broad net of emplacements is intended to increase the chances of survival of the batteries by changing the emplacements when it is confirmed that the enemy has identified the battery position. This maneuver is executed to decoy the enemy and surprise him with fire from emplacements unknown to him. The number of emplacements and the frequency of redeployment are shown in the example of an antiaircraft artillery regiment defending the city of Vinh. This regiment has 80 emplacements, and in seven months it performed 205 redeployments with 13 batteries.

30. The gaps between batteries and the distances of emplacements from the target depend on the anticipated method of enemy operation against a particular target and on the need for the concentrated fire of several batteries against an enemy target. The average distance between batteries should be:

- up to two kilometers for 100 mm and 80 mm antiaircraft guns;

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- under 1,200 meters for 57 mm antiaircraft guns;
- from 500 to 600 meters for a 37 mm anti-aircraft artillery battery.

The average distance between battery and target, on the other hand, should be:

- from three to four kilometers for 100 mm and 85 mm antiaircraft guns;
- up to 1,200 meters for 57 mm antiaircraft guns;
- from 600 to 700 meters for 37 mm anti-aircraft guns.

31. If an antiaircraft artillery regiment is deployed in ambush, the distance between batteries may be considerably shorter than those given above. The early detection and identification of targets to be destroyed constitute a particularly significant responsibility of the regiment's combat operations.

32. Regiments and batteries receive information on the air enemy from the following sources:

- the radar recognition system [redacted] deployed in radiotechnical units arranged in either centralized or decentralized fashion (from the widely deployed radio-technical company);
- the early-warning radar system organized in early-warning radar companies of an antiaircraft artillery division;
- the visual observation post system of antiaircraft artillery (there are 8 to 12 visual observation posts in a regiment) and militia units.

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Moreover, with the aid of artillery radar, the regiment organizes group target searches.

33. During the firing the antiaircraft regimental commander strives to concentrate his fire on a single group, and even on a single aircraft within the group. At the same time, the commander strives to ready suitable forces to fire at enemy aircraft arriving from other directions. These forces should consist of not less than one or two batteries. It is very difficult to concentrate the fire of several batteries on a single target; that is why this problem is receiving a great deal of attention in training and during combat. The guidelines of an artillery regiment's fire direction are prepared in advance in the form of a regimental fire plan which includes all of the most probable variants of anticipated enemy action against a protected target. This plan is discussed with the regimental cadre, then given to each gun crew. The entire regiment is then trained in accordance with the elements of the plan.

34. During a fire fight with an air enemy, the simultaneous fire of several batteries is concentrated on the leading aircraft in the group. The fire plan also stipulates that the small caliber antiaircraft artillery should destroy the enemy at the maximum firing range. If the air target begins to maneuver, the artillery may conduct barrage fire. During a dive, the artillery should fire directly at the target. The small caliber antiaircraft artillery should destroy the air target on the approaches, during the dive, and while the aircraft is pulling out of the dive.

35. A great deal of importance is attached to the appropriate organizational disposition of the regimental commander's command post. The principle followed here is one of ensuring that the regimental commander can observe the air situation both visually and on the map; he should also be able to follow the course of the regiment's fire fight.

36. The North Vietnamese point to the following difficulties which the antiaircraft artillery is encountering in combatting U.S. aircraft. The enemy

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uses various maneuvers with single aircraft, pairs of aircraft, and aircraft in V-formation (changes in direction, altitude and speed). The enemy also flies both at low and at high altitudes. Several aircraft simultaneously attack targets from a dive as well as in a climb. Thorough reconnaissance precedes every air raid, and during the raid the enemy employs various radioelectronic countermeasures.

37. The 57 mm gun batteries are the most effective units under these conditions. However, the 100 mm gun is also used against the enemy on his approaches to the protected target. Antiaircraft machine guns and the 37 mm gun can be used only in daylight against low flying enemy aircraft.

Use of Antiaircraft Artillery to Defend Fixed Targets

38. Methods of Providing Cover for Fixed Targets. Artillery cover of fixed targets is provided by anti-aircraft artillery in two ways.

39. The first type is "target defense" [redacted] in which the antiaircraft artillery is located in emplacements adjacent to or directly at the target. The artillery which has been allocated provides cover for the target and is responsible for active defensive operations in a specific area. Because of the nature of target defense, this type of operation requires many, well constructed emplacements and a good road network for maneuvering in the target area.

40. The second type is "mobile defense" [redacted] which is based on the use of large scale operational maneuvering in an area in which many targets are to be defended. This type of operation is carried out by creating ambushes along those lines of approach to the target which are advantageous to the enemy. In addition to the antiaircraft artillery, fighter aircraft and antiaircraft missiles play an active role in these ambushes.

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41. Antiaircraft Defense of a City. The enemy has attacked all the cities of North Vietnam. Some cities have been completely demolished, while in others only such major industrial installations as rail stations, power plants, et cetera, have been destroyed. In other cities only the suburban areas have been destroyed. Thus the intensity of enemy raids depends on the character and the importance of a city; it is reflected in the number of antiaircraft artillery guns used to cover a city and in the method of deploying this artillery in a tactical grouping.

42. Initially, antiaircraft batteries were grouped around the entire city, forming a peripheral defense. The current plan calls for the concentrated defense of major industrial areas and, simultaneously, for less intensive peripheral defense of the entire city. In forming a tactical grouping, therefore, a detailed evaluation should be made of the methods and possibilities of enemy attack against a particular section of, or a single target within, the city being protected and also of the city's topographical features and approaches. In addition to concentrating anti-aircraft artillery so as to defend a particular part of the city, battery elements are deployed outside the city along the enemy's most likely directions of approach.

43. In covering a city, the batteries are distributed in groups, and the following distances between units are maintained: 1,000 to 2,000 meters between 57 mm antiaircraft gun batteries and 500 to 1,000 meters between 37 mm gun batteries.

44. The method of organizing antiaircraft artillery defense of a city stems primarily from the necessity of countering most effectively the method of bombing cities which the enemy has lately been employing. According to this method, enemy aircraft approach the target city at an altitude of about 5,000 meters. About 5,000 meters from the target, the aircraft, in group formation, dive at a 45 degree angle, release their bombs, climb to an altitude of about 2,000 meters and depart the target area. During such an attack the aircraft maneuver and employ

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active electronic countermeasures. When the enemy follows this method of attack, he is destroyed by friendly aircraft and antiaircraft missiles either during the incoming flight (i.e., before reaching the zone of fire of the antiaircraft artillery covering the city) or during his departure from the target.

45. Antiaircraft Defense of Airfields. The primary targets of enemy attacks against airfields are parked aircraft, runways, barracks and fuel depots.

46. [] Comment: Pages 200 through 203 of the original document are missing. These pages covered the end of the section on "Antiaircraft Defense of Airfields" and the beginning of a section entitled "Organization of the antiaircraft artillery divisional commands. The text of page 204 begins with paragraph 47.]

47. Moreover, [subject unknown] gives tactical support to the target being protected, and plans and supports the execution of a tactical movement by the division's forces.

48. The independent antiaircraft artillery regiments perform a similar role. One of the responsibilities of the antiaircraft artillery regiment is "tactical-fire direction" [] This consists of indicating to the battery the installation to be covered, the area in which emplacements are deployed and, in favorable circumstances, the enemy target to be destroyed. The regiment is also responsible for organizing and carrying out fire support both in the unit and in conjunction with adjacent forces, for executing tactical movements and for planning and carrying out shifts in the regiment's fire. The regimental commander pays particular attention to the preparation and the subsequent precise execution of the regimental fire plan. His responsibilities include directing the fire of the regiment and the constant updating of the fire plan.

49. The antiaircraft battery commander directs the fire of his battery and executes the fire direction orders of the regimental headquarters. Fire direction

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at battery level consists mainly of concentrating the fire of all battery guns on a single target. The battery commander may designate the target for destruction. In this case the battery commander is guided by the instructions given in the regimental fire plan. Among the major duties of a battery commander are selecting a suitable method of firing, the type of fire, and the times for opening and ceasing fire, and directing the shifting of fire during a raid.

Antiaircraft Artillery Teamwork

50. Antiaircraft artillery units cooperate very closely with both fighter aircraft and antiaircraft missile units in combatting air targets.

51. Antiaircraft artillery units cooperate with fighter aircraft in areas of common concern. Priorities in the selection of targets remain the responsibility of fighter aircraft. In order to insure greater security in cases of joint action with the air force, the antiaircraft artillery may fire only with the use of a fire control radar [redacted] or on carriage optical fire control [redacted].

[redacted] The specifics are worked out between the antiaircraft artillery and Fighter Aviation when the former provides cover for a fighter airfield.

52. Two points which help ensure the security of the friendly [North Vietnamese] air force are its relatively small strength and the fact that it is provided with only two types of aircraft, namely, the MIG-17 and the MIG-21PF. Moreover, these aircraft operate near their parent airfields, of which there are very few. The artillerymen have no difficulty in recognizing the MIG-17 because the U.S. air force has no aircraft with a similar silhouette. However, they have difficulty in differentiating between the very similar silhouettes of the MIG-21 and the F-105.

53. Cooperation with the antiaircraft missile forces is organized on the basis of mutual cover and in accordance with a previously prepared plan. This cooperation is planned in great detail when the anti-

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aircraft artillery and missile units are ordered to ambush enemy air targets. The basic procedure in such cases is for the antiaircraft missile units to open fire first, followed by the antiaircraft artillery. If the missile units fail to fire at the target, then the antiaircraft artillery units may open fire without waiting for further action by the missile units.

Ammunition Expenditure and Enemy Losses

54. The expenditure of antiaircraft artillery ammunition required to bring down a single aircraft has increased. In the initial stage of the war, the average expenditure of ammunition per downed aircraft totaled 800 to 900 artillery shells. For every enemy aircraft brought down now, the average expenditure is about 5,000 projectiles from antiaircraft guns and machine guns. This increase is explained by the continuing improvement in the enemy's methods of operating its aircraft and by the various enemy countermeasures against North Vietnamese artillery radar equipment. It should also be noted that antiaircraft artillery and machine guns have recently been introduced into the equipment of the militia-type subunits, which are not yet well trained.

55. Enemy losses inflicted by artillery and antiaircraft machine guns have been relatively high. For example, of the total of 1,619 enemy aircraft destroyed between the beginning of the war and 31 December 1966, antiaircraft artillery and machine guns have accounted for 1,265, or about 80 percent of all enemy aircraft brought down over North Vietnam.

Conduct of Combined Air Operations

56. The North Vietnamese armed forces have recently begun to wage an advanced form of air war, namely, combined air operations. These operations call for the massing of a large number of antiaircraft defense units for the achievement of a specific operational objective. Such an objective might be the destruction of a large number of enemy aircraft or the prevention of an air attack on either a single target or a group

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of targets. These operations are conducted by anti-aircraft artillery divisions and antiaircraft missile units operating in a particular area, by reserve antiaircraft artillery and missile units, and by units regrouped from other, less important areas. Also taking part in air operations is Fighter Aviation, which can participate actively only for certain stages of an operation. It is generally agreed that a combined air operation may last for several days.

57. During the course of the operation, the anti-aircraft defense troops and equipment involved are shifted extensively. Moreover, antiaircraft artillery units are used for ambushing the enemy on approaches to the basic formation of antiaircraft defense forces deployed for a given operation. The operation is under the overall command of an antiaircraft artillery division commander, who also uses his command post for the operational formation. As a rule the Air Force and [] is the body which plans and organizes such an air operation.

C. ORGANIZATION AND COMBAT OPERATIONS OF THE MISSILE FORCES

Organization, Ordnance and Disposition

58. The North Vietnamese antiaircraft missile forces form one of the branches which make up the Air Force and [] The missile units are subordinate to the Missile Forces Command, which, although a separate command, is a part of the Air Force and [] The basic organizational missile unit is the regiment comprising four to six firing battalions and one technical battalion. The firing battalions are equipped exclusively with the SA-75M [] type missile system and 11D missiles capable of hitting targets at altitudes between 500 meters and 27 kilometers. Each firing battalion has two to three 37 mm artillery batteries of six guns each and three platoons of twin-mount (quad-mount) antiaircraft heavy machine guns. Each platoon has four guns. The mission of these [artillery] units is to provide a [firing] battalion with cover from low altitude enemy air attacks.

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59. The technical battalions are divided into two independent assembly lines [] which operate in separate areas. The missiles are prepared [] only at night; during the daytime the assembly equipment [] is dispersed along a five to ten kilometer radius from the preparation area. An area which is wooded or otherwise well camouflaged is selected as the site for preparing the missiles and for deploying the equipment. Because of the low rate of fire of a missile firing battalion, one assembly line is used for preparing missiles, while the other is held in reserve, ready to become operational at any moment.

60. The disposition of missile units varies in accordance with the importance of the target to be defended. A large target is generally encircled by two rings of firing battalions. The first ring is formed between 10 and 15 kilometers from the target to be defended. The mission of the battalions in this ring is to fire in front of and above the target. The second ring is formed between 30 and 40 kilometers from the target, with the majority of the battalions grouped in the basic direction of the attack. The mission of the battalions in this ring is to fire on the approaches to the target and in pursuit of departing enemy aircraft. Such firing is intended to prevent the enemy's accomplishing his mission, to break up his tactical formations and to create advantageous firing conditions for the battalions in the inner ring. The frontal distance between battalions of the particular rings ranges from several to 20 kilometers, thus assuring that adjacent battalions can cover each other against air attack.

61. In addition to the basic disposition of battalions in the most likely direction of enemy attack, several additional battalions are deployed from 50 to 70 kilometers or more from the target. The mission of these units is the destruction of aircraft employing active or passive countermeasures, reconnaissance

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aircraft and drones, as well as aircraft flying in close combat formation. Hiding in ambush, these battalions, which are considered reserve battalions of the Air Force and [redacted], divert the enemy's aircraft from the primary target, surprise him and disrupt his combat formation. Apart from its organic antiaircraft artillery, each battalion is additionally assigned three 57 mm antiaircraft batteries, each equipped with six guns, but without radar or a gun director.

62. The 37 mm and 57 mm gun batteries are dispersed at a distance of 1,500 to 2,000 meters from the missile battalion emplacements; the antiaircraft machine gun platoons, at a distance of 200 to 700 meters. The antiaircraft artillery and machine gun complex is under the command of the Deputy Battalion Commander for Artillery, who operates from the missile battalion command post. The role of these antiaircraft artillery units is limited to maintaining combat readiness and to providing a general indication of the enemy's direction of attack. Because the target is followed with optical instruments, this system is adequate.

Movement Tactics

63. Movement is still considered one of the basic tactics for ensuring the survival of the missile forces' tactical grouping. The principle has been adopted that either a firing or a technical battalion must move whenever an emplacement has been detected by the enemy or when a missile has been launched. In other instances, the battalions redeploy in conformity with the plan of the Air Force and [redacted], usually at intervals of one to three months. The battalions deployed at the farthest approaches move more often and over considerable distances, even up to 200 kilometers. Movement is executed only at night, and only to previously prepared and camouflaged emplacements. Each firing battalion has several (three on the average) primary emplacements completely prepared and camouflaged, one or two alternate emplacements at which engineering work has been done only for the radiotechnical batteries, and one dummy emplacement with mock equipment made from local materials. Some battalions have set up

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emplacements which simulate a missile launch, using explosives or fuel barrels for this purpose. The explosives at these emplacements are ignited simultaneously with the launching of missiles at the primary emplacements. There are also alternate emplacements at which no engineering work has been done but which have been camouflaged with trees and shrubs, and at which areas for equipment have been prepared. On the average, the battalions move from 20 to 35 kilometers from their previously held emplacements. The movement to the new emplacement is made in several groups, each comprising several vehicles. After breaking camp, each group moves out when it is ready. This method has proved necessary because of enemy air attacks against columns on the march. With such a dispersal, the rate of march is about 15 kilometers per hour. Based on past experience, a battalion can cover between 50 and 70 kilometers in one night.

64. It should be noted that antiaircraft artillery organic to a firing battalion does not have its own heavy transport equipment. The missile regimental staff provides this equipment for the period of the move. A separate problem is the removal of equipment from the emplacement and its preparation for the march. Since the terrain is flat and marshy, the prime movers cannot remove the equipment from the emplacement without extra manpower. The militia and the local populace are used for this purpose. Civilians also help to camouflage the emplacements and equipment, evacuate the wounded, pour water on the launchers, and assist in setting up quarters for the troops. According to Vietnamese statements, the battalions would not be able to carry out their assigned combat missions were it not for civilian help.

65. The frequent movement of firing battalions and the consequent jarring of equipment on rough roads have shown that the SA-75M equipment is quite rugged. About two hours are required to bring the equipment to a state of full readiness.

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Experience Gained from Combat Activity

66. The accumulation of combat experience has enabled the Vietnamese People's Army to develop effective tactics against the enemy in the air. By 1 April 1967, the North Vietnamese missile forces had downed 365 U.S. aircraft (265 U.S. aircraft had been downed prior to 1 February 1966) and had captured 70 aviators. The enemy was forced to turn to new tactics such as maneuvering, active electronic countermeasures, and destruction by missiles of the SAM emplacements. During 1967, U.S. aircraft entering the kill zone have been using evasive maneuvers (change of altitude, course, and speed). At the same time, tactical formations have been divided into small groups, which arrive over the target from different directions. During most raids, the guidance stations have been actively jammed.

67. Apart from the experience gained to date (reflected in the recommendations on the conduct of fire published in 1967 by the USSR Defense Ministry under the title "Combat Use of Antiaircraft Missile Forces Based on the Experience of the North Vietnamese People's Army"), the Vietnamese [] are paying special attention to training operators in the techniques of manual tracking on the guidance radar, which is employed against targets which use maneuver tactics. These operators are trained on simulators for an average of two hours daily. During the approach of targets to a defended object, electromagnetic energy is radiated for the minimum possible distances, thus ensuring an opportunity of firing at the target (about 30 to 40 kilometers from the missile guidance station). In order to avoid exposing the missile guidance stations, the early warning radars start radiating simultaneously with the guidance station. This increases the enemy's difficulty in promptly locating the firing battalion's emplacements. If the air situation is not complicated, early warning radars are not used at all. The best trained missile battalions (those having the most combat experience) are distributed on the coast and in the major directions from which U.S. aircraft operate within the country. A great deal of

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importance is attached to the method of firing "in pursuit" [] of the target, since electronic countermeasures are then less intense; this permits effective fire at the enemy aircraft.

68. When jamming activity is strong, either [] antiaircraft binoculars or the D-49 range finder is used to guide missiles to multiple targets. The final firing data which are prepared are based on approximate parameters which are used as the initial firing data. Aside from its physical effects, missile fire affects the morale of the enemy aircraft crews. The aircraft break formation and often do not carry out their assigned mission. In breaking formation, the aircraft leave the protection of their active jamming zone, thus enabling the missile units to fire at them.

69. The "three-point" method is used to fire against targets employing evasive maneuvers. This method of guidance gives better results and provides protection against air-to-surface missile attack when the missiles are brought out on the launching rail. This is especially true when firing at aircraft which are diving or flying at low altitudes.

70. It is becoming increasingly clear that the U.S. Air Force is feeling the effects of the anti-aircraft artillery and missile attacks, and that it is therefore trying to neutralize this action. During bombing raids on assigned targets, additional U.S. aircraft simultaneously attack missile emplacements. F-4 or F-8 aircraft are used for attacking the emplacements of a missile battalion; they are formed into one group or several, and always fly about 300 meters below the groups bombing the target. Special raids are mounted only against antiaircraft artillery and missile emplacements. The number of aircraft in these raids is greater, totaling between 12 and 48. The emplacements are attacked with bombs and "Shrike" and "Bullpup" guided missiles as well as with machine guns. These attacks initially caused the subunits considerable losses in personnel and equipment, but with the passage of time, effective countermeasures

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have been developed. Experience has shown that firing at the targets before they attack the emplacements yields good results. The aircraft under fire disperse and attack aimlessly and with uncertainty, or they depart the area without having accomplished their assigned combat mission. The emplacements are well camouflaged, thus making it difficult for the enemy to carry out air photographic reconnaissance. Radio silence is also maintained.

71. A missile battalion's equipment (vans) is covered with matting made from such local materials as bamboo. Without this cover, bomb fragments would penetrate the van's walls, wounding crew members or damaging equipment. Similar cover is also provided for cable lines and for the wheels of the vans and other vehicles. The missiles which are on transporters and the auxiliary equipment of a missile battalion are dispersed. The missiles are painted a protective green.

72. A method of operation has been developed to counter "Shrike" missile attacks against guidance stations. Once a surface-to-air missile (SAM) has been launched against an aircraft which has fired a "Shrike" missile, the distance from the SAM to the target aircraft and the distance from the "Shrike" to the guidance station are determined. If the distance from the SAM to the target aircraft is less than the distance from the "Shrike" to the guidance station, the latter directs the SAM to the target in the usual way. After the SAM has either hit the target or passed alongside it, the guidance station's antenna is rotated on a horizontal plane for one to three seconds in the direction of the "Shrike's" flight path and then the antenna signal is switched over to the dummy load. This action causes the "Shrike" to "pull away" a safe distance from the guidance station (between 500 and 3,000 meters). If the distance between the "Shrike" and the guidance station is less than the distance between the SAM and the target aircraft, the guidance station's antenna is directed upward in order to cause the self-destruction of the SAM. The "Shrike" is then diverted by the aforementioned method. The "Shrike" is always diverted to the right, if it comes into sight from the right side,

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or to the left, if it comes into sight from the left side. Rotation of the guidance station's antenna should be steady with a gradual increase in rotary speed. If the operators are working the manual tracking system with the automatic gain control switches on, "Shrike" missiles can be observed on the guidance station's indicator screens for an operational range of five kilometers.

Joint Operations with Fighter Aviation

73. Joint operations of missile units with Fighter Aviation are organized on the basis of zones and times. In practice, fighter aircraft do not enter the missile units' zone of action. There does exist, however, a general plan for joint operations, and the details are worked out daily for the following day. Consideration is given to the capabilities and resources of the missile forces and Fighter Aviation in particular areas and directions of operation. If action by fighter aircraft will guarantee success, friendly /i.e. North Vietnamese/ aircraft, after warning the missile command post, may enter the missile units' zone of fire. The missile units do not fire when friendly fighter aircraft are present in their zone of fire.

74. Particular attention is also paid to air tactics of friendly and enemy aircraft. The unexpected entrance into the missile units' zone of fire of a friendly aircraft is recognized by its flight pattern. The friendly aircraft does not maneuver and it does not use jamming; it also replies to the signal enquiring whether it be friend or foe, in order to inform the friendly subunits of its nationality.

Combat Readiness and Command

75. Each missile battalion has three complete relief crews. The first crew is the primary one, the best trained and prepared for combat. The second and third

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are reserve crews. The third relief is, for the most part, made up of the youngest and least well trained troops. Duty is discharged according to a schedule; however, if a massive attack is expected, the first crew assumes the duty.

76. Each missile battalion has 12 prepared missiles (one firing unit), of which six are on launchers and the remaining six on dispersed transporters. Three of the dispersed missiles are located approximately one kilometer from the launch sites, and the remaining three are about four kilometers from the launch site. After the firing begins, the missiles are delivered on signal, always starting with those nearest to the launch site.

77. Duty at the battalion command post is performed by the commander, the deputy commander for technical matters, or the chief of staff.

78. Duty at the command post of a missile regiment is also performed in three shifts, during each one of which it is assumed by the commander, the deputy commander for line affairs, or the chief of staff.

79. As a separate branch of service, the missile forces have their own central command post, the main task of which is to organize the command of the subordinate missile regiments. The central command post of the missile units makes a detailed daily analysis of friendly and enemy capabilities, in which it considers the aerial situation, draws conclusions concerning its own defense and operations, decides on actions to be taken, and organizes cooperation between Fighter Aviation and antiaircraft artillery.

80. Close fire control is exercised at both the regimental and battalion levels. It should be noted that command is greatly decentralized. In practice the missile regiment's command post indicates the target to the battalions, and the decision to open fire on individual targets is then made by the battalion commander. This system is used because the radiotechnical forces do not furnish continuous data concerning the enemy, especially when he is operating at low altitudes or in mountainous areas.

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D.

ORGANIZATION AND COMBAT OPERATIONS OF
FIGHTER AVIATION

Status, Organization and Deployment of Fighter Aviation

81. Air defense Fighter Aviation is organized into independent regiments, directly subordinate to the North Vietnamese Air Force and [] Command. A Fighter Aviation regiment consists of three squadrons of a single type of combat aircraft, i.e., MIG-21BF's or MIG-17's.

82. Fighter Aviation is a new type of aviation and until the outbreak of destructive /air/ warfare, it did not exist in North Vietnam. It therefore began combat operations with no previous experience or knowledge of the characteristics peculiar to the conduct of flights over friendly territory. The first air battle was fought on 3 February 1965 in defense of the Kam-Roi bridge. In this battle a V-formation of MIG-17's shot down two F-8 aircraft.

83. By July 1967 Fighter Aviation had improved and acquired greater skill, despite the fact that even the best trained combat pilots had had only four years of flying experience. Within a two-year period of operation, groups of MIG-17 aircraft shot down a total of 63 enemy aircraft. MIG-21PF's shot down at least 51 aircraft and probably destroyed 10 others.

84. There are only five airfields in North Vietnam suitable for jet aircraft. These airfields are located in a limited area around Hanoi and Haiphong, and this fact lessens the possibilities for combat action at distant approaches.

85. Each Fighter Aviation regiment is assigned a permanent airfield as well as auxiliary airfields. The regiment assigns its entire force either to a single airfield or to two or three, depending on the situation and the degree of escalation of the war.

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Conditions for Conducting Combat Operations

86. In view of the limited capabilities for replenishing the losses in flight personnel and equipment, North Vietnamese Fighter Aviation conducts air battles only under the most favorable conditions.

87. Because of the limited area for combat operations and those topographical features which enable enemy aircraft to make undetected approaches from various directions, all aircraft formations are located in the area where enemy aircraft are expected to operate.

88. The progressive escalation of the destructive war results in trained and strengthened forces. Nevertheless, it constitutes a grave danger. The enemy recently conducted an air operation which was designed to destroy the North Vietnamese Air Force. This operation consisted of the constant bombardment of nearly all airfields, the destruction of aircraft during takeoff and landing, and air ambushes. The operation did not bring about the expected results, as evidenced by the enemy's increase in fighter protection during group raids.

89. Despite the fact that the national character of the war facilitates the repair of damaged airfields and the maneuverability of forces, it complicates joint operations with the ground-based antiaircraft defense elements.

Missions of Fighter Aviation

90. North Vietnamese Fighter Aviation has narrowly defined missions because of the comparatively small number of aircraft available, the limited capabilities for deployment and the unfavorable conditions for air operations.

91. The following are the basic missions of Fighter Aviation:

- Defense of the capital and other important North Vietnamese targets;

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- Destruction of U-2 reconnaissance aircraft and BQM-34a unmanned reconnaissance aircraft;
- Destruction of RB-66 aircraft with electronic countermeasures systems.

92. When the enemy is not conducting air raids against the Hanoi area, the aircraft are assigned the following additional missions.

- Cover Highway No. 5;
- Cover the port of Haiphong;
- Cover the missile battalions during their redeployment;
- Cover the defense fortifications along the Red River.

Method of Conducting Combat Operations

93. Fighter aircraft may participate in operations both while in an alert status at airfields and while on patrol flights. During the operation a detailed analysis is made of the air situation. An analysis is also made of enemy air tactics in order to enable friendly fighter aircraft to pursue enemy fighter-bomber groups while avoiding contact with enemy fighters. The need to economize forces dictates these actions.

94. Combat operations of fighters on patrol flights are conducted from patrol sectors. In the initial period of war the aircraft performed patrol flights in a sector in a "circular" or "figure eight" pattern, at a speed of 700 to 750 kilometers per hour. The sectors were located along the probable lines of approach of enemy aircraft, which made it easier for the leading enemy cover group to clear the approach routes of North Vietnamese fighters.

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95. Experience has proven that in order to repel aircraft attacking at speeds of 900 to 950 kilometers per hour, it is best to keep the fighters in a patrol sector at a distance of 15 to 20 kilometers from the line of flight to the target. At this distance, it is possible to space the fighter aircraft in line of attack, to reach the desired altitudes for attack, and to select individual targets for the fighters /See Figure 46/.

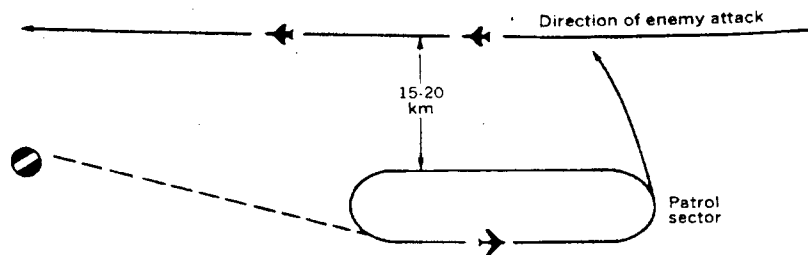


Figure 46. Plan of interception from air patrol position

Initially, patrol aircraft maintain a speed of 650 to 700 kilometers per hour. After detecting the target, the command post alerts the fighters and prepares to vector. Meanwhile, the fighters switch on their afterburners and climb to an altitude 500 kilometers higher than the altitude of the target. If the target consists of Air Force aircraft, the fighters increase their speed to 950 to 960 kilometers per hour; if the target is naval aircraft, they accelerate to 800 to 850 kilometers per hour. Flying in the direction of the aircraft, the fighters select their targets.

Command and Direction of Fighter Aviation

96. The Fighter Aviation command is centralized at the main command post of the Antiaircraft Defense. The main command post is assigned the following missions:

- a. to draw up daily missions for the fighter regiments;

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- b. to approve operational plans;
- c. to organize the takeoff of fighter aircraft for combat with air targets;
- d. to organize joint operations between the Air Force and Antiaircraft Defense;
- e. to report on the air situation;
- f. to organize joint air operations with groups from other regiments;
- g. To vector fighters to air targets.

97. The fighter regiment command post cannot order fighters airborne on its own authority. The exercise of command by the command post includes the provision of target information to the pilots and control of fighter operations.

98. The fighter aircraft are guided directly by "indicators" [] or plotting boards of the vectoring system. In the past, there has been much inefficiency in the use of [] equipment.

99. At the fighter regiment's command post in a revetted shelter there is also a forward observation post with a ultrashort-wave radio; this post can directly control the air battle over an airfield. It operates under the Vietnamese conditions of limited air missions and a limited area of operation.

100. In order to provide protection for combat at low altitudes, auxiliary control points are organized in the likely directions of enemy attack. An R-809 radio is located at such observation points, which are manned by two or three persons, including one officer who keeps the aircraft crews informed of the air situation. In the event of a large area of probable combat, two observation points approximately 20 to 30 kilometers apart are established. each point is equipped with a chart of orders. Sections of the aft fuselage or stabilizers are painted in various colors to avoid errors. A fighter aircraft regiment may

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organize two auxiliary control points. The practical usefulness of auxiliary control points is great, especially in mountainous areas.

Joint Operations with Surface Antiaircraft Defense

101. The organization of joint operations raises great demands in view of the large number of different types of surface antiaircraft weapons in the vital but limited regions of Hanoi and Haiphong as well as the Red River valley, where North Vietnamese fighter aircraft also operate.

102. The organization of joint operations is the responsibility of the central command post of the Air Force and OPL; this is the official high command of Fighter Aviation regiments, missile regiments, and anti-aircraft units and formations.

103. In order to ensure the continuity of joint operations, the command post of the fighter regiment includes missile and antiaircraft control officers, who inform their units of the type of air activity. These officers give the commander of the fighter regiment data concerning their unit formations and communications systems. The command post of the fighter regiment relays to the missile regiment's command post, data concerning flights scheduled for the following day as well as the routes to and from the patrol sector (and the time). At the same time, information on friendly fighters is passed from the control points to the special plotting board located at the command post of the missile regiment.

104. Airfields located in the missile units' zone of fire are assigned incoming and outgoing corridors in which the missile units do not fire.

105. Joint operations of the air force with missile units are carried out in individual zones or in combined zones. Joint operations in combined zones are executed on the basis of a division of sectors as well as of time.

106. In situations where fighters require fire support, joint operations are possible, but in such cases

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the fighters fly below 3000 meters.

107. Previous practice has revealed that the SRO-2 IFF system cannot ensure the positive recognition of friendly aircraft, especially when the aircraft mingle with those of the enemy.

108. Joint operations of the Air Force with antiaircraft artillery are generally executed in separate zones. In principle, the Air Force combats targets up to a distance of 10 kilometers from the highway or up to the target defended by artillery and it will not enter the zone of fire without previous warning.

109. In special circumstances joint operations are conducted in a combined zone with a division of operations only on the basis of time.

110. Concerning fire support for fighters, anti-aircraft artillery will, upon request, open fire on those targets which are more than two kilometers distant from the aft end of the fighter. In such cases the sighting is done by optical instruments. Antiaircraft artillery will fire on those targets designated by the commander of the fighter regiment. Fighter aircraft and artillery will jointly combat the enemy over an airfield only under ordinary atmospheric conditions and with the use of optical instruments by the artillery.

111. If there is insufficient time to warn the anti-aircraft artillery that the fighters will enter its zone of fire then the aircraft must avoid the zone. If the fuel supply does not permit them to skirt the zone of fire, the fighters will fly over the 37 mm firing zone at altitudes of over 3,000 meters and the 57 mm firing zone at altitudes of over 5,000 meters.

Airfield Security

112. That part of the work in airfield construction which was intended to ensure the dispersal of the airfield's equipment and personnel has turned out to be inadequate. The small number of airfields and their location in the zone

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of active enemy air operations, compel the air regiments to disperse those aircraft which are not on alert status to a distance six to eight kilometers from the runway. MI-6 helicopters are used to help disperse the aircraft. One helicopter can transfer a fueled MIG-17 or an unfueled MIG-21PF. About 25 minutes are required to transfer one aircraft a distance of 10 kilometers, or about 15 minutes from the time the helicopter is ready.

113. Parking areas for aircraft on alert status are located at various points on the airfields. They are revetted and roofed as protection against fragmentation bombs. Shelter areas for personnel and auxiliary equipment have also been constructed at the airfields. All sectors of the airfield are camouflaged with any available materials and dummy aircraft have been constructed to confuse the enemy.

114. The aircraft are kept in repair by regimental and airfield personnel, nearby residents, and civilian construction and engineering enterprises. Destroyed sections of runway are repaired by the insertion of hexagonal concrete panels, the sides of which are one meter long. The panels are then covered with asphalt or concrete.

115. Airfield repairs are directed by an airfield repair committee which consists of the regimental commander, a member of the provincial Party committee, a regimental engineer, an air force commander, and other specialists as required. This committee draws up a repair plan, determines the equipment required, and provides the necessary number of people to do the work.

Method of Conducting Aerial Combat

116. North Vietnamese Fighter Aviation repels enemy air attacks by groups of aircraft, which usually consist of a pair of MIG-21's and a V-formation of MIG-17's. The MIG-17's operate at altitudes of less than 3,000 meters and the MIG-21PF's at altitudes above 3,000 meters. MIG-21PF's are used principally to intercept air targets and to make quick strikes, rather than to engage in /prolonged/ battle.

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117. The following elements are necessary to guarantee success in battle:

- great determination;
- a high degree of piloting skill;
- taking the air enemy by surprise;
- optimum use of the combat equipment of friendly (North Vietnamese) aircraft.

Combatting Air Targets with MIG-21PF's

118. In comparison to the F4C fighter, the MIG-21PF has greater capabilities for gaining altitude, greater acceleration at altitudes above 4,500 meters and greater horizontal maneuverability at altitudes above 5,000 meters.

119. Best results are achieved by attacking at an altitude slightly above 500 meters and at a reduced speed of 250 to 300 kilometers an hour, and then pulling out in a steep climb or some other vertical maneuver.

120. The following principles should be observed in conducting aerial combat with the MIG 21PF:

- a. In aerial combat the MIG-21PF should be used on the /enemy's/ approaches to the target, beyond the range of ground weapons. Because of the great similarity of its silhouette to that of the F-105 and its great turning radius, the MIG-21PF is more vulnerable to ground fire than the MIG-17.
- b. Because of belated detection of targets and the enemy's use of radar jamming, combat operations should be limited to patrolled zones located along the lines of probable enemy approach and at altitudes which ensure that the fighters are concealed from the enemy.

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- c. Through the use of the ground vectoring system and the capability of the fighters themselves to detect distant targets, tactical superiority over the enemy should be ensured. For this purpose, best advantage is taken of the sun and clouds. Under normal atmospheric conditions, the RP-21 radar is not used for search, because the signal it emits is picked upon the radar scope of the enemy aircraft, thereby permitting the enemy to resort to tactical or electronic countermeasures. When ground controlled intercept is utilized with the RP-21 radar turned off, it is best to approach the target at an angle of 90° ; with the RP-21 radar operating, the target should be approached at an angle of 135° . It is best for the fighters to conduct independent search and detection from altitudes of 1,000 to 1,500 meters above the flight altitude of the target.
- d. In the approach for the attack, the speed of the fighters must be superior to that of the target aircraft.
- e. The crews must be able to fire effectively during the initial attack, since this will determine the success of the operation. Immediately after firing they must withdraw from the attack and climb to a higher altitude, so as to avoid battle with enemy fighters.

121. K-13 guided missiles are most frequently used in combatting air targets. The K-13 has a high kill probability against a target aircraft flying horizontally and not maneuvering a great deal. If, however, the target aircraft turns or rolls, then the kill probability of the K-13 is very low, and is surpassed by the "Sparrow" missile carried by the enemy's aircraft. An average of 1.5 to 1.8 K-13 guided missiles are currently being fired to destroy one aircraft. The best firing range for this missile at altitudes below 5,000 meters is between 1,000 and 1,500 meters, with a maximum range of 2,000 meters. When the firing range is greater than this,

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the percentage of kills diminishes by approximately 10.

122. To date, when the K-13 missile has been fired at the DRONE 157-J from an aircraft while in a climb, it is done at an altitude of 150 meters, using the PKI gun-sight and the rocket signal. The target was sighted below the central cross mark of the sight by 15-thousandths [probably 15 mils].

123. During the period when F-105 aircraft flew without fighter escorts, S-5 unguided rockets were also used to destroy air targets. These rockets proved less effective than the conventional weapons system of the MIG-17. The reason for this was the wide scattering pattern of the rockets and the lack of an adequate range finder on the aircraft. It was discovered that the best results were achieved when these rockets were fired from a distance of 600 meters. It was also discovered that at speeds of MACH 1.1 a break occurs in the electrical conduits leading to the pods with the S-5 missiles. The S-5 firing equipment was also modified to enable it to fire in salvos of 6, 8, and 10 rockets from a single pod.

Combatting Air Targets with MIG-17's

124. MIG-17 aircraft have good capabilities for combat at altitudes below 3,000 meters and are most effective at altitudes between 500 and 2,000 meters. This results from the limited maneuverability and the limited maximum speed of this fighter-bomber aircraft when flying with external stores and in a specific formation. The enemy's fighter aircraft, on the other hand, have a limited amount of combat time in which to use guided missiles, and the horizontal maneuverability of the MIG-17 enables it very easily to evade enemy missiles. At altitudes below 3,000 meters, MIG-17 aircraft have better horizontal maneuverability than the F-4C aircraft; in comparison with the F-8 naval aircraft, however, this maneuverability is about equal.

125. When engaged in aerial combat in pairs, one aircraft attacks and the other defends the attacker. In

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a V-formation combat group, the second pair of aircraft constitutes the defensive component. During the search and entry into battle, a V-formation of MIG-17's executes its flight in the following formation:

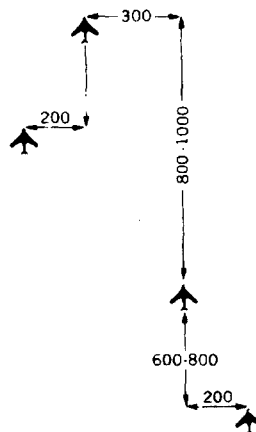


Figure 47. MIG-17 V-formation during search and entry into battle

126. When combatting air targets, MIG-17's are armed with conventional weapons. Firing is conducted in short bursts of 25 to 30 rounds from three small cannons. The best firing range is from 200 to 400 meters from the target. An average of one ammunition allotment is expended in the destruction of a single aircraft. The 37 mm cannon has been very successful; after being hit, the target aircraft bursts into flames.

127. The great maneuverability of the MIG-17 and the short range at which it fires at the enemy's fighter-bomber aircraft preclude the enemy's use of missiles to repel MIG-17 attacks. This has forced the enemy to mount conventional weapons on F4C aircraft.

128. The MIG-21PF is frequently used to defend the MIG-17, and it engages enemy fighters at higher altitudes. Prior to combat, the MIG-21PF's are located in zones within which they fly at a speed of 1,000 kilometers an hour, at an altitude above 2,000 meters, and provide close cover for the MIG-17's. MIG-21PF and MIG-17 aircraft do not fight at the same altitude in the same zone.

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Effectiveness of North Vietnamese Fighter Aviation

129. During the two-year period of combat North Vietnamese fighter aircraft have shot down a total of 114 enemy aircraft, including the following types: LB-66; F-105; F4C; F-8; A-4; A-6; BQM-34a and 147J. In a two-month period during the first quarter of 1967, a total of 54 intercepts was made, and in 33 instances of open fire, 38 enemy aircraft were destroyed.

130. The ratio of intercepts to aircraft destroyed by a MIG-21 regiment is as follows: during 160 sorties made during December 1966, 52 encounters were made with enemy aircraft, an intercept percentage of 32.5. These intercepts resulted in the destruction of 10 enemy aircraft. From 19 April to 25 May 1967, a total of 127 sorties was flown and 38 encounters were made with enemy aircraft; in the 29 percent of sorties resulting in intercepts, 19 enemy aircraft were destroyed.

131. During the two-year combat period, a MIG-17 regiment detected 167 targets which resulted in 116 intercepts. This represents 96 percent effectiveness/sic7. Between 18 April and 5 July 1967 this regiment engaged in 23 battles in which it destroyed 30 aircraft. Up until this time, the aircraft of this regiment had engaged enemy aircraft in battle an average of once every third combat flight. The data on the results of air battles do not constitute the only or even the most important indicators of the effectiveness of the North Vietnamese fighter aircraft. This tabulation does not take into consideration the number of times fighter-bomber groups have been dispersed or the number of bombs which, instead of reaching their targets, were released in panic during the flight. Fighter Aviation operations also compel the enemy to provide fighter cover groups for fighter-bombers in a ratio of 1:1. As a result, every second aircraft carries no bomb load, thus decreasing the general effectiveness of the air strikes.

Loss of Friendly Air Equipment

132. During combat operations, MIG-21PF losses amounted to 45 or 50 percent of the losses which this

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aircraft inflicted on the enemy. This represents a loss ratio of 1:3 in combat against small enemy aircraft and 1:1 in repelling large strike forces.

133. The pilots' increased combat experience has recently lessened friendly losses. For example, during April and May 1967, MIG-21PF losses amounted to 36 percent of the number of enemy aircraft which they destroyed. MIG-21 pilot losses amounted to 5 percent /not further explained/. In fact, light fire by MIG-21PF's has caused enemy pilots to eject because of damage to the vulnerable hydraulic and electrical systems of their aircraft. In contrast, even those MIG-17 aircraft which receive five times as many hits from 20 mm shells, land safely on the airfields. Practice flights proved that a pilot could eject himself from his aircraft at an altitude of 120 meters at a slight angle of ascent. On the other hand, at a diving angle of 45° and a speed of 950 kilometers per hour the pilot cannot eject himself below an altitude of 1500 meters. If the windshield is damaged before ejection, the canopy must be dropped; if it is not, it will be damaged and will not detach itself from the ejection seat.

134. It was also found that the wing fuel tank hits the horizontal stabilizer when released during a slight dive and easy slide.

135. The ratio of MIG-17 aircraft losses to kills is 1:7.5. In operations conducted at altitudes below 2,000 meters the loss ratio is 1:9 or 10; above 2,000 meters it is 1:5 or 6.

136. The damage to MIG-17 aircraft can be divided into three categories:

- a. damage sustained while airborne, either from enemy aircraft or from North Vietnamese ground air defense weapons;
- b. damage resulting from forced landings;

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c. damage inflicted during air collisions.

137. About two-thirds of this damage can be repaired, including, in some cases, the damage caused by a missile strike. Between 7 and 10 days are required to repair an aircraft damaged by a 20 mm cannon shell.

E. IDENTIFICATION OF THE AIR ENEMY AND ORGANIZATION OF A WARNING SYSTEM

Organization and Operational Principles of the Radiotechnical Forces

138. The radiotechnical forces are an arm of the Air Force and [] and are commanded by the Radiotechnical Forces Command, acting as an independent command of the Air Force and [] Command.

139. Under the Radiotechnical Forces Command are radiotechnical regiments, each consisting of 10 to 13 companies. A radiotechnical post, made up of two to five radar stations, (depending on the mission to be carried out) is included in the radiotechnical company. Radiotechnical regiments have two types of radiotechnical companies, i.e., companies with the exclusive mission of detecting and identifying the air enemy, and companies which detect and guide the North Vietnamese fighter aircraft to the targets. The basic equipment of the first type of company consists of radar stations P-10, P-12, P-15, and 406 (the last being Chinese produced); the basic equipment of the second type of company consists of radar stations P-30 and P-35. Each radiotechnical regiment contains from 8 to 12 visual observation posts; each post is manned by eight soldiers. In addition to these posts, each radar station has a similar visual observation post. The organization of the radiotechnical forces calls for the formation of two types of radiotechnical regiments: one for identifying the air enemy and a second for guiding the North Vietnamese fighter aviation to the air targets.

140. Radiotechnical companies for detection and identification follow the general principles governing the deployment of radiotechnical forces. Radiotechnical companies for guiding fighter aircraft are deployed directly in the airfield area of the fighter aircraft regiment and are subordinate for tactical purposes to the regimental commander. If the radiotechnical

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regiment contains independent radiotechnical companies for guiding the fighter aircraft, these companies are deployed at the advanced approaches to the airfield in the most probable directions of an enemy air raid. The heavily mountainous and wooded nature of the North Vietnamese terrain makes radar coverage very difficult. This terrain causes additional difficulties by creating blind spots and causing the radar to echo numerous topographical objects. Radar stations are posted on the highest terrain and in positions which provide overlapping coverage. Special attention is given to familiarizing operators with the mental and visual imagery of radar echoes from topographical objects.

141. On flat terrain, the radiotechnical companies are deployed at intervals of 50 to 60 kilometers, with the need for overlapping coverage and the positions of adjacent radar stations being taken into account. In laying out a radar net, provisions are made for providing particular radiotechnical companies with radar stations having various frequency ranges. Thus stations operating on meter and decimeter frequency bands are responsible for detecting targets at low and medium altitudes, whereas stations operating on centimeter frequency bands are responsible for tracking targets at high altitudes.

142. The frequent movement of radiotechnical companies is a basic operational principle of the radiotechnical forces. The general rule is for companies to make at least four moves during the course of a year. Each radiotechnical company is supposed to have three or four main positions in readiness and the same number of positions in reserve. In addition, they are supposed to construct dummy positions. In general, the main positions are not used in peacetime.

143. In posting the watch schedules of the radiotechnical companies, consideration is given to the fact that most of these stations are located where it is impossible to use the power supply of the industrial power network. This situation requires exclusive use of the stations' own power source, thereby limiting the stations' operational time. A radiotechnical company normally stands watch for a two to three hour period. The company stands five to

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six watches in a 24-hour period /sic/.

144. Two states of combat readiness are applicable in the radiotechnical forces: combat readiness No. 1 and combat readiness No. 2.

145. Combat readiness No. 1 is divided into two states: normal readiness and intensive readiness. During a state of intensive readiness, the most competent shifts stand watch and the entire company command is present at its command post. This state of readiness is in force in the following situations:

- in case of an anticipated air raid from either high or a low altitude;
- in a period of active electronic jamming by enemy aircraft;
- in case of an anticipated massive raid by enemy air forces.

The regimental command post and the central command post of the radiotechnical forces are obliged to maintain either the normal or the intensive stage of the No. 1 state of combat readiness. Comment: The No. 2 state of combat readiness is not described. The regimental staff tests combat readiness at least twice every 24 hours; radiotechnical companies conduct such tests only once every 24 hours.

Detection and Identification of the Enemy

146. On North Vietnamese territory, radiotechnical companies form radar networks, designed only for aircraft identification. North Vietnam does not maintain a continuous low altitude radar network. The low altitude radar network is supplemented by visual observation posts.

147. Radiotechnical companies responsible for aircraft identification are deployed throughout the country; their main effort is concentrated in the directions of the Gulf of Tonkin and of southern Laos. On the other hand,

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the radiotechnical companies assigned to guide fighter aircraft are deployed directly at the airfields where the fighter aircraft are based. The visual observation posts are deployed in groups, each having three to four posts; these, in conjunction with the group's information collection posts, represent one collection component. A regiment can deploy three to four collection components.

148. Data from the collection posts are forwarded to the radiotechnical regiment's visual observation post. Company visual observation posts are located at intervals of 15 to 20 kilometers and 20 to 30 kilometers from the collection post, which in turn is deployed at a distance of 40 kilometers from the regimental visual observation post. Type R-109 radio stations are used for communications in the visual observation system. The collection post is also the data relay point between the collection component and the observation post of the radiotechnical regiment.

149. The method of reporting on airborne targets in the radiotechnical system of identification is as follows:

- the individual radar stations telephone the data on detected airborne objects to the radiotechnical company's command post;
- the radiotechnical company, after disseminating the data by radiotelegraphy, transmits these data within the antiaircraft defense grid system to the radiotechnical regiment's command post;
- the radiotechnical regiment, after collecting the data from the individual companies, radiotelegraphs the disseminated data to the radiotechnical forces command post.

150. From the moment of detection by the radar station to the moment of receipt at the central command post the time required for transmitting data on airborne objects is about 2 minutes and 45 seconds.

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151. Information on air targets obtained in the visual identification system is circulated as follows:

- the individual visual observation posts report by radio the data on air targets which have been detected to the group collection post;
- the collection post, after gathering and collating the data, transmits them by radio to the radiotechnical regiment's visual observation post.
- the regimental post, after collecting and collating the data, supplements them with information obtained from the radar identification system and transmits them by radio-telegraph to the central post of the radio-technical forces.

152. The data on air targets obtained by the radar observation system are transmitted by the plotting board method using the grid system. On the other hand, the data obtained by the visual observation system are transmitted with the aid of "plotting tables" using polar coordinates. This system gives certain data on targets, such as the composition, number, and type of aircraft participating in the raid, their formation, and the intervals between the particular groups or echelons of aircraft. In case of enemy action, the visual observation posts also describe the nature of this action and the results of the counteraction by the North Vietnamese

153. Independently from the enemy air identification systems developed by the radiotechnical troops, the visual observation post system is organized by the militia-type forces at the various administrative levels such as villages, settlements, towns, districts, and provinces. Information on air targets which have been detected is transmitted by telephone to a higher level post and so on to the highest level. Information assembled at the provincial level is transmitted directly to the central command post of the radiotechnical forces via the national communications network.

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Informing and Alerting the Troops

154. The air target identification system of the radiotechnical troops has both a centralized and a decentralized warning system.

155. The centralized warning system disseminates data on airborne targets by radio from the central command post of the radiotechnical forces. These data are received by the command posts of the [] forces, Fighter Aviation, and the antiaircraft artillery units of local forces.

156. The decentralized warning system transmits data on airborne objects from command posts of the radiotechnical detection and identification companies to the command posts of the nearest active [] units.

Alerting the Civilian Population

157. The central command post of the Air and [] Forces alerts the antiaircraft defense command posts of the military zones to the air enemy. The command posts of the military zones in turn alert the provincial antiaircraft defense command posts, which then alert the district command posts. The antiaircraft defense command posts of both the military zones and the provinces also receive data from the radiotechnical companies in their areas. These command posts receive supplementary data from their own visual observation posts. The provincial antiaircraft defense command posts direct the antiaircraft alert in the districts and towns assigned to them.

158. The national capitol has its own antiaircraft defense command post which is alerted by the central command post of the Air Force and [] Forces. The adjacent military zones and provinces are responsible for keeping each other informed on the air situation in their areas. The transmission of data is primarily dependent on the national telephone communications network; therefore, the data on the air enemy are transmitted without the use of call signs.

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F. ANTIAIRCRAFT DEFENSE WITHIN THE TERRITORIAL DEFENSE SYSTEM

159. Antiaircraft defense within the territorial defense system includes:

- evacuation and dispersal of the population and national property;
- construction of shelters;
- camouflage;
- observation and alerting;
- emergency rescue work;
- combat action against air targets.

Evacuation and Dispersal of the Population and National Property

160. The Committee for the Dispersal of Population and Industry directs all matters connected with evacuation and dispersal. The National Defense Ministry determines the timing of evacuation and the evacuation area. The individual ministries are responsible for planning a correct evacuation procedure. The provincial and district authorities are responsible for making living arrangements for the population in the new areas and organizing the production of the evacuated plants at their new sites.

161. The duration of evacuation may be permanent, periodic /i.e., wartime/, or temporary.

162. Permanent evacuation is primarily applicable to the population of threatened villages. These people receive land in hitherto undeveloped areas where they are expected to remain even after the war.

163. Periodic evacuation is mainly applicable to the population of towns, primarily children and elderly persons, and to certain factories, schools, institutions of higher learning, and important offices. The evacuees are expected to return to their former residences and work after the war.

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164. Temporary evacuation is organized for a period of several days when information is received about the intended bombardment of a specific locality (area or factory).

165. Evacuation, especially of factories, frequently entails the complete reorganization of the production system. Evacuation of factories assumes various forms, i.e., both complete and partial evacuation, change of work hours (for example, night work only), dispersal of the manufacture of factory components, et cetera.

166. Great attention is given to providing adequate living conditions for the evacuees and to the organization of schools, kindergartens, and nurseries, a responsibility of the local authorities. People are forbidden to concentrate in towns and villages; for example, fairs and bazaars have been eliminated and replaced by networks of shops and canteens.

167. The larger depots and warehouses have been dispersed. Here a simple but effective dispersal method, which shows a high degree of social responsibility on the part of the North Vietnamese, has been applied. For example, we observed unguarded crates of equipment and materiel dispersed for scores of kilometers along the roads.

Construction of Shelters

168. There has been massive construction of shelters. It is estimated that there are now about 20 million such shelters. It is the duty of each citizen to have one or two shelters. In addition, group shelters of brick or concrete with capacities of 50 to 100 persons are built in towns. Single occupant shelters constructed of concrete blocks with light movable covers are erected along the streets. All shelters are of the air raid type and without air filtering equipment. Factory shelters are built both outside and inside the plant.

169. In the villages, shelter construction, combined with the system of defensive preparations, can be used as

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a resistance point. Individual shelters are connected by trenches and underground tunnels. Some villages, especially in the southern part of North Vietnam near the 17th Parallel, have already created an entire system of shelters and underground tunnels where the inhabitants spend most of the day for protection against the continuous air strikes, naval bombardment, and artillery bombardment by the South Vietnamese forces. We were informed that a single village has built 28 kilometers of underground tunnels and open trenches.

170. Village shelters are constructed primarily from local materials: bamboo, wood, clay, and dirt. We observed that each family in the village possessed two or three shelters; one was inside the dwelling while the main and reserve shelters were outside.

171. A basic problem is maintaining and improving the shelters and protecting them against underground water damage. To this end, the local authorities are required to inspect all the shelters at least twice a month.

Camouflage

172. Great importance is attached to camouflaging roads, bridges, warehouses, factories, and means of transportation. Camouflaging is done mainly with vegetation, especially with fast growing banana plants. We noted very few sophisticated camouflage techniques.

173. It is necessary to mention some of the camouflage measures employed:

- driving without lights or with only blackout lights mounted near the vehicle's wheels;
- making detours, camouflaged by day and unveiled by night, around the bombed sections of roads;
- transferring machinery from factories which have been bombed to cellars which are still intact;
- at night completely illuminating the small

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towns and villages which have been evacuated.

174. A night-time blackout of North Vietnamese towns is not mandatory. Our Vietnamese comrades emphasize that this action has a positive psychological impact on the population. Towns are blacked out only after an air-raid warning has been sounded.

Observation, Warning, and Alert

175. The development of a uniform observation, warning, and alert system under the conditions existing in North Vietnam at the present time is very difficult because of the relatively underdeveloped communications system and the lack of adequate communications equipment, especially in the villages. Because of these conditions, an interrelated central and territorial system has been formed.

176. The province is the primary unit of the territorial system. The provincial antiaircraft defense command organizes its own visual observation posts, which are equipped with radio communication, and it receives radio signals from the central system's radiotechnical companies located in the province. These data are transmitted to the military zone command where they form the basis for alerting the particular districts or counties and the commands of the local antiaircraft defense forces to a threat.

177. The district organizes its own observation and warning system in the small towns and hamlets for use by the subordinate antiaircraft defense forces and for carrying out local alerts, because two-way warning signals cannot be transmitted between the central system and villages in the allotted time.

178. In towns the population is alerted by sirens; in villages, by drums and gongs. It must be emphasized that an alert is sounded only in case of extreme necessity, so as not to disrupt production and force the population to seek shelter too frequently. In Hanoi, an alert is sounded only when the aircraft are 20 kilometers from the city.

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179. There is a well organized warning system on all main highways. Every one or two kilometers, there is a station with "Air Defense lamps" (at night), which alert drivers to the threat of an air attack. A green light indicates that the road is safe and a red light indicates that aircraft are aloft. Until recently the designations were reversed.

Rescue Work

180. The following types of units are organized for rescue work:

- sanitation brigades;
- salvage brigades;
- fire fighting brigades;
- bomb disarming and disposal brigades;
- road and bridge reconstruction brigades;
- antichemical defense brigades.

181. These brigades are organized in villages, settlements, small towns, large city precincts, and certain factories. The brigades are divided into stationary and mobile units.

Combat Action Against Air Targets

182. All local forces, militia and self-defense units undertake active antiaircraft defense at all levels of the territorial system.

183. Antiaircraft units of the local forces are armed with 12.7 mm machine guns and small caliber anti-aircraft guns. The militia and self defense units attack enemy aircraft mainly with infantry weapons (hand operated rifles, machine guns, and 12.7 mm machine guns). Some militia and self defense units act as 37 mm antiaircraft gun crews.

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184. The Vietnamese comrades stressed three fundamental aspects of their widespread and active anti-aircraft defense system:

- U.S. aircraft are fired at from every insignificant village and from every factory, thereby producing a great impact on the people's morale;
- this fire inflicts losses on the Americans, despite the most modern aviation equipment at their disposal; the effectiveness of even infantry weapons is emphasized by the fact that these weapons have thus far accounted for about five percent of the total number of aircraft destroyed;
- anti-aircraft gun crews, supplemented by militia and self-defense units, represent a trained and well integrated reserve for the anti-aircraft artillery units of the local forces and the regular army.

185. The village of Quang Tuong (Quang Son District, Thanh Hoa Province) [] can serve as an example of this wide spread and active anti-aircraft defense system. Five gun emplacements have been built for the anti-aircraft defense of this village, including three gun emplacements for 12.7 mm machine guns with stationary crews and two gun emplacements manned, in case of alert, by women armed with infantry weapons. They work in a textile cooperative.

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